Fortschritte der Hochfrequenztechnik. Vol. 4. Edited by J. ZENNECK, M. STRUTT, AND F. VILBIG. Pp. 321. Akademische Verlagsgesellschaft, Frankfurt am Main, Germany, 1959.

This volume contains eight articles covering the advances in several areas of electronics and related fields up to about 1957. Previous volumes have appeared at irregular intervals, but it is the intention of the editors to publish future volumes yearly. It has become a custom of European review publications to use several languages side by side, and this book is no exception. Five of its eight articles are written in English and the remaining three in German.

The volume opens with a review of tropospheric and ionospheric scatter propagation by J. B. Wiesner. Inhomogeneities in the medium cause local variations of the dielectric constant, so that the incident wave cannot travel in a straight line. Beyond-the-horizon propagation is thus possible. A brief outline of the theory is given; beyond that, the article concentrates on the presently available experimental facts. Detailed data of the characteristic properties of both modes of scatter propagation are included, as well as a thorough discussion of communication systems employing these modes.

In the second article (in German) H. Poeverlein treats the propagation at low and very low frequencies. Data on the relation of field intensity to distance, and on the phase and polarization of these waves are presented. The influence of ionospheric disturbances on the propagation is discussed. A brief chapter is devoted to the so-called sferics, the short, oscillatory electromagnetic disturbances which are generated by lightning discharge. Several theories of low-frequency propagation are discussed in fair detail. In the mode theory the space between earth surface and ionosphere is treated as a wave guide. An equivalent theory obtains if the incident and reflected waves are superimposed. The Appleton-Hartree formula, which is essentially based on geometric-optical analogy, may also be utilized to describe low frequency phenomena although it was originally derived for high frequencies. The article concludes with a discussion of low-frequency noise.

An account of the development of high-frequency transistors is given by R. L. Pritchard. The high-frequency performance of transistors is characterized by a set of five internal parameters which bear a direct relation to the physical structure of the transistor. The influence of the design on these parameters is then discussed, and data on the circuit performance of the (then) latest high-frequency transistors are shown. One cannot help wondering about the extraordinary progress in this particular field since this article was written.

The fabrication techniques for high-frequency transistors are treated in the fourth paper by R. N. Hall. An account of processes for the introduction of impurities, such as melt-doping, diffusion, and alloying, is presented, followed by a review of methods of measurement of the physical parameters of transistors.

A. van der Ziel gives a very interesting review of noise in semiconductors. Besides the ubiquitous thermal noise, shot noise and current noise are of importance. Shot noise is caused by the fact that the crossing of potential barriers by the current carriers is a random event. Experimental results can be accounted for by corpuscular theory or by a diffusion model. Current noise (also frequently called $1/f$ noise), on the other hand, is generated by spontaneous fluctuation of the number of current carriers and by carrier recombination.

Statistical phenomena are also the subject of the subsequent article (in German) by H. W. König and H. Pötzl, who treat the fluctuation of current in an electron beam. Assuming uniform velocity in a one-dimensional beam except at the cathode (which is excluded for simplification), they show that the linear theory of space charge waves may be reduced to the theory of linear networks. The theory is first developed for periodic excitation. Random fluctuations are treated by means of generalized Fourier analysis. The influence of a section of the beam (represented by a linear network) on the fluctuation process is then expressed by a transformation of the power spectrum. Two noise parameters, which are invariants of the transformation, completely describe the fluctuation process. Methods for evaluation of these parameters are discussed. In this paper the references are not given at the appropriate place of the text, as usual, but at the end of each section only. This practice renders the selection of the proper reference more difficult and detracts from the value of this otherwise very informative article.

Recent research on periodic, lossless delay lines is summarized by K. Pöschl (in German). Methods of obtaining phase, group, and energy velocity are given. The theory is based on Hill's differential equation with periodic boundary conditions. Any wave type in a periodic line is given as a multiplicative solution of the boundary problem and is a sum of partial waves of equal frequency and different phase velocity. Each partial wave satisfies the wave equation, but not the boundary conditions, separately. The coupling of a mode of the line with an electron beam in the center of the cross-sectional plane is subsequently discussed and a treatment of the equivalent filter network

representation given. Finally, an account of approximation methods is presented for the solution of the periodic boundary value problem, such as replacement of the periodic line by a suitable homogeneous one, sectional solution of the wave equation, and fitting of the free coefficients to the boundary conditions in the plane of separation of adjacent sections. Results for a number of particular cases are finally reported.

The last article, by J. S. Wagener, reviews the properties of getters in electronic tubes. Flash getters and bulk getters, their preparation, and absorption properties are treated.

This volume shares its virtues and its faults with the majority of similar review publications. It is most valuable for those readers who want information on the latest developments in fields closely related to their own specialty. The bibliography is extensive and covers both American and European literature. The total number of references runs up to an impressive 654.

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